Product Requirements

Arizona State University

EGR 314: Embedded Systems Design 2

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Team 302

Professor: Kevin Nicolas

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**Introduction**

We are a group of engineers who have been tasked with developing a mobile weather station. This station will be equipped with two serial sensors which can measure temperature, atmospheric pressure, wind speed,humidity, or other metrics upon approval and transmit the data via WiFi. Additionally, the station will include a motor which will enable us to remotely actuate an object of our choice according to the weather conditions. While this project will be challenging, it is also an opportunity to utilize our expertise to create a novel and cutting-edge product. We have the utmost confidence that we will be able to successfully execute this project and produce a mobile weather station which is both precise and dependable.

**Objectives**

Our main goal is to create a device that requires minimal input from the user and provides accurate and reliable data about weather conditions in one region. We want the device to be as autonomous as possible, while offering wireless capabilities that allow the user to access this information from anywhere in the world. The device would be able to be used by anyone with a low level of meteorological knowledge and have the capability to be in an outdoor extreme setting for extended periods of time.

**Stakeholders**

**Guest Speakers.** A representative of a manufacturer of weather sensors or wireless communications equipment or a representative of a governmental entity utilizing weather data.

**Groupmates**. Engineers and computer scientists with experience in embedded systems and wireless communication along with students and professionals interested in creating innovative weather monitoring solutions.

**Showcase goers.** Favor a product that is easy to set up, use, and maintain that will offer them accurate and reliable information for years to come.

**Prof. Kevin Nicolas***.* Ensures the project and groups stay on the pre-approved timeline and meets the predetermined goals of the project.

**Use Cases**

**User Story #1: Jamiroquai**

Twenty-five-year-old Jamiroquai is a small farmer from Yuma, Arizona, who has been involved in farming since the age of five. He is a proud inheritor of his family's farm, and is dedicated to sustainable farming methods. Jamiroquai is constantly looking for ways to enhance his farming practices, and is particularly interested in utilizing technology to increase his efficiency and productivity. Recently, Juan has been researching the use of a mobile weather station to aid in the irrigation of his crops. A mobile weather station detects rainfall, temperature, humidity, along with other relevant data, and transmits the data to a server. This data can then be accessed on Jamiroquai's smartphone or computer to determine the weather surrounding his farm, which can then be used to calculate the amount of water needed to irrigate his crops.

**User Story #2:Kim**

Kim is an amateur meteorologist with a passion for weather prediction and investigation. She is constantly striving to enhance her abilities and understanding of the subject, and is convinced that a mobile weather station could be a beneficial asset to her. Mobile weather stations are devices that are capable of automatically collecting and storing data like rainfall, temperature, and humidity which can be utilized to refine weather forecasts and investigate the implications of climate changes. Kim is optimistic that a mobile weather station could enable her to refine her forecasts and make greater contributions to meteorological research. Kim is looking forward to utilizing the mobile weather station, and is confident that its capabilities will enable her to reach her objectives. Additionally, she is eager to share her data with other meteorological and research professionals, allowing them to use it to enhance their weather predictions and research.

**User Story #3: Morgan**

Morgan, a retired outdoorsman with a lifetime of experience in the wilderness, is determined to improve the safety of hikers, trail walkers, and off-roaders. He has an appreciation for the difficulties associated with predicting distant trail conditions, and is particularly interested in the potential of mobile weather stations to enhance trail safety. By gathering real-time weather information, Morgan believes that he can more accurately predict when trails may be subject to inclement weather conditions, such as rain, snow, and other potential hazards. This information can be used to reduce the risk of accidents, ensure the safety of all individuals on the trails, and improve preparations for all outdoor goers.

**Aspects**

**1.** **Product Design**

The product design will be based on current market options and include improvements on them such as:

1.1 The product shall be made of weather resistant material.

1.2 The product shall include necessary hardware for accessory access.

1.3 The product shall incorporate an inoffensive design.

1.4 The product shall include all necessary accessories color matched to the main unit.

1.5 The product shall have an easy to access power port.

1.6 The product shall be as small as comfortably possible.

1.7 The product shall include a large backlit display.

1.8

**2** **Functionality**

2.1 The product shall incorporate all necessary radios for wireless communication.

2.2 The product shall offer a large data collection container.

2.3 The product shall incorporate an atmospheric sensor to determine barometric pressure.

2.4 The product shall have a month(s) long battery life.

2.5 The product shall use a resistive or ultrasonic sensor for rainfall measurements.

2.6

3 **Interactivity**

3.1 The product shall function and pair to the outside device and the user’s device.

3.2 The product shall offer data emptying functions including data collector emptying via remote motor actuation.

3.3 The product shall offer an interactive touchscreen displaying data.

3.4 The product shall offer a standby mode that displays ambient weather information.

3.5 The user interface shall be intuitive for all users after reading the manual.

3.6 The product's functions and data shall be accessible from a web application.

3.7

4 **Adaptive Intelligence**

4.1 The product shall provide real-time automatic weather updates to the user.

4.2 The product shall perform automatic sensor calibration.

4.3 The product shall automatically empty its data collection container once full and after the data has been logged.

4.4 The system shall enter standby mode once direct interaction has been finished.

5 **Customization**

5.1 The product shall offer multiple means of weather data collection.

5.2 The product shall offer multiple purchasable display packages.

5.3 The product shall be user configurable with purchasable add-on sensors.

5.4 The product shall be offered in different finishes and colors depending on the material selected for production.

6 **Manufacturing**

6.1 The total FOB cost price of the product shall be <$125.

6.2 Parts must be mass-producible in batches of 10,000 parts.

6.3 The product shall be designed to assemble in under 2 minutes..

6.4 The position of any component cannot change during assembly.

6.5 Functioning of the device shall be easy to check by the manufacturer.

6.6 The product shall be designed to consist of the minimum possible amount of parts.

6.7 The product shall be calibrated during manufacturing.

6.8 The product shall be constructed to be user serviceable.

7 **Regulations**

7.1 The product shall pass a standard ASTM D 1148 test for discoloration from UV light and heat.

7.2 The product shall pass a standard MIL-STD-810 humidity test.

7.3 The product shall pass MIL-STD-810 Methods 501, 502, and 503 tests for extreme temperatures.

7.4 The product shall pass a standard ASTM B117 test for salt fog conditions.

**Open Questions**

· Can we move towards a recyclable and repairable product?

· Can we improve on our signal strength and reliability?

· Can we improve data accuracy and transmission?

· Is there a way to integrate the data into smart home systems?

· Can we incorporate new sensors and data collection devices into our ecosystem?

**Milestones**

Concept presentation: 08/30/2023

Design presentation: 10/11/2023

Design freeze: 11/08/2023

Planned release: 12/04/2023

**Appendix A: Competitive Analysis**

**Explanation of Terms**

*ASTM* American Society for Testing and Materials

*MIL-STD* Military Standard

*FOB* Free On Board. The total cost price of manufactured goods, including shipping to the target destination.